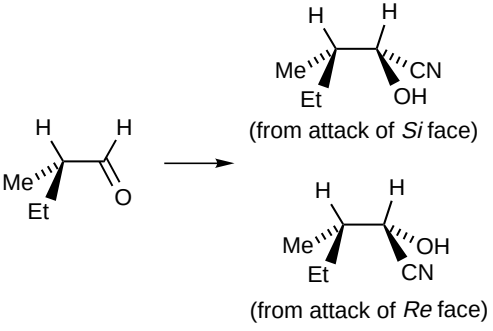
prochirality

This term is used in different, sometimes contradictory ways; four are listed below.

1. The geometric property of an achiral object (or spatial arrangement of points or atoms) which is capable of becoming *chiral* in a single *desymmetrization* step. An achiral molecular entity, or a part of it considered on its own, is thus called prochiral if it can be made chiral by the replacement of an existing atom (or achiral group) by a different one.

An achiral object which is capable of becoming chiral in two desymmetrization steps is sometimes described as proprochiral. For example the proprochiral CH_3CO_2H becomes prochiral as CH_2DCO_2H and chiral as $CHDTCO_2H$.

2. The term prochirality also applies to an achiral molecule or entity which contains a trigonal system and which can be made chiral by the addition to the trigonal system of a new atom or achiral group. For example addition of hydrogen to one of the enantiotopic faces of the prochiral ketone $CH_3CH_2COCH_3$ gives one of the enantiomers of the chiral alcohol $CH_3CH_2CHOHCH_3$; the addition of CN^- to one of the *diastereotopic* faces of the chiral aldehyde shown below converts it into one of the diastereoisomers of the cyanohydrin. The two faces of the trigonal system may be described as *Re* and *Si*.



3. The term prochiral also applies to a tetrahedral atom of an achiral or chiral molecule which is bonded to two *stereoheterotopic* groups. For example, the prochiral molecule CH_3CH_2OH can be converted into the chiral molecule CH_3CHDOH by the isotopic replacement of one of the two enantiotopic hydrogen atoms of the methylene group. The carbon atom of the methylene group is called prochiral. The prochiral molecule $HO_2CCH_2CHOHCH_2CO_2H$ can be converted into a chiral product by

esterification of one of the two enantiotopic $–CH_2CO_2H$ groups. The carbon atom of the CHOH group is called prochiral. The chiral molecule $CH_3CHOHCH_2CH_3$ can be converted into one of the diastereoisomers of $CH_3CHOHCHDCH_3$ by the isotopic replacement of one of the two *diastereotopic* hydrogen atoms of the methylene group. The carbon atom of the methylene group is called prochiral. The stereoheterotopic groups in these cases may be described as *pro-R* or *pro-S*. Reference to the two stereoheterotopic groups themselves as prochiral, although common, is strongly discouraged.

See *chirality centre*.

4. The term prochirality is also applied to the enantiotopic faces of a trigonal system.

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